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<p>(21) International Application Number: <b>PCT/US97/01738</b>            (22) International Filing Date: 30 January 1997 (30.01.97)            (30) Priority Data:            08/598,922 9 February 1996 (09.02.96) US            08/673,309 28 June 1996 (28.06.96) US            08/781,619 9 January 1997 (09.01.97) US</p> <p>(71) Applicant: AVERY DENNISON CORPORATION [US/US]; 150 North Orange Grove Boulevard, Pasadena, CA 91103 (US).</p> <p>(72) Inventors: GESP, Marc; Varenstraat 59, B-2300 Turnhout (BE). BOGAERTS, Bert; Vlaamse Gaai 3, B-25300 Boechout (BE).</p> <p>(74) Agents: CORSO, Joseph, J. et al.; Pearce, Gordon, McCoy &amp; Granger, 1200 Leader Building, Cleveland, OH 44114 (US).</p>		(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, LZ, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).
<p>Published <i>With international search report.</i></p> <p>(54) Title: DIAPERS HAVING PRECOMBINED MECHANICAL CLOSURES</p> <p>(57) Abstract</p> <p>A diaper (10) has a multi-layer tab (32) or tape assembly (32) arranged to form the user joint with a mechanical securement portion (54), and to provide at least one adhering or adhesive securement portion (52) for maintaining tab stability as the tab (32) is assembled with the diaper (10) and during tab (32) storage on the diaper (10) prior to tab (32) deployment. The adhering securement portion (52) includes a separation interface or separable bond portion that is separable to provide exposed non-adhesive surfaces upon tab (32) deployment to the fastening position. The separable interface or bond portion is provided by a transferable release coat that remains with and covers an otherwise exposed adhesive surface, a non-pressure sensitive adhesive or cohesive, or separable or peeling films. A central finger lift may be provided to facilitate proper layer separation and deployment of the tab (32) during use.</p>		

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**1           DIAPERS HAVING PRECOMBINED MECHANICAL CLOSURES**

2           This application is a continuation-in-part of  
3           application Serial No. 673,309, filed June 28, 1996,  
4           which in turn is a continuation-in-part of application  
5           Serial No. 598,922, filed February 9, 1996.

6           **BACKGROUND OF THE INVENTION AND RELATED ART**

7           The present invention relates to fastener' tab or  
8           tape assemblies for use in closure of disposable diapers  
9           or securement of other garments. The tab includes a  
10          fastening element that is deployable to effect garment  
11          closure with a mechanical joint. For convenience, the  
12          invention is described hereinafter with respect to diaper  
13          applications.

14          Diapers of the type of interest herein are widely  
15          used. A typical diaper construction comprises an  
16          absorbent pad or batt core enclosed in an outer liquid  
17          impermeable shell or backsheets and an inner liquid  
18          permeable shell or top sheet. The backsheets may comprise  
19          a plastic film such as a polyethylene film or a non-woven  
20          fabric laminated with such a film.

21          The fastener tab assemblies are typically fastened  
22          to one end of the diaper at each lateral side or  
23          longitudinal edge of the diaper in a permanent "factory  
24          joint" by the diaper manufacturer using adhesives or  
25          other techniques. The tabs are releasably attachable to  
26          the other end of the diaper in a "user joint". The  
27          attachment is releasable both to allow permanent removal  
28          of the diaper and to allow unfastening to inspect the  
29          diaper followed by refastening if indicated. The user  
30          joint may be formed by connection of the tab to a  
31          "landing member" on the diaper backsheets or directly to a  
32          fibrous backsheets in the case of a non-woven backsheets  
33          laminates construction. In the case of plastic film  
34          shells, the landing member is often provided as a

1 reinforcing tape including exposed mechanical fastening  
2 elements or a knit type fabric landing pad.

3 The fastener tab assembly includes multiple layers  
4 that are secured together along their lengths with  
5 varying degrees of bonding including substantially  
6 permanent bond portions and separable bond portions. The  
7 bond portions maintain the assembly of the tab layers and  
8 proper alignment thereof during application of the tab to  
9 the diaper and while the tab is in the storage position.  
10 The separable bond portions are "opened" to separate  
11 lengthwise segments of the tab layers during deployment  
12 of the tab to form the user joint.

13 The provision of a mechanically fastening user joint  
14 is advantageous since it eliminates the occurrence of  
15 insufficient adhesion for effective diaper closure due to  
16 contamination of adhesive surfaces by baby powder or oil,  
17 or some other type of contaminant. The elimination of  
18 the user adhesive bond portion is advantageous during the  
19 manufacture of such tabs, and may be more convenient also  
20 during diaper usage since no adhesion layer is available  
21 for inadvertent attachment, e.g. to a non-woven backsheet  
22 or to other accidental targets. However, such a  
23 mechanically fastening user joint does not contribute to  
24 the stability of the tab in the storage position if it is  
25 disposed against the plastic film backsheet.

26 It important that proper separation occurs during  
27 deployment, that is, separation occurs at proper  
28 interfaces with appropriate portions of layers being  
29 maintained with associated layers. Accordingly, there is  
30 a need to provide secure bonding for maintaining the  
31 assembly prior to deployment while simultaneously  
32 assuring reliable separation of layers. These objectives  
33 present somewhat contrary construction requirements. It  
34 is desirable to achieve both objectives in a construction

1 that is sufficiently reliable to assure a commercially  
2 acceptable product without excessive costs.

3           Additional adhesive layers or portions have been  
4       used in combination with mechanical fastening to provide  
5       closure with an arbitrary location on a plastic film  
6       backsheets upon rolling the soiled diaper for disposal and  
7       also to contribute to the tab stability during storage.  
8       Such combined mechanical and adhesive fasteners are  
9       disclosed in U.S. Patents 4,869,724, 5,019,065 and  
10      5,053,028. The additional adhesive layers in such tab  
11     systems may serve to impede deployment of the tab for  
12     diaper closure. A tab delamination introducing zone is  
13     disclosed in US Patent 3,833,456, owned by the assignee  
14     of the present application, and also in US Patent  
15     5,549,591 wherein a portion of the adhesive layer is  
16     deleted or rendered ineffective by masking at the  
17     beginning of the intended separation location.

## **18 SUMMARY OF THE INVENTION**

19        The present invention provides a multilayer tab or  
20      tape assembly arranged to form the user joint with a  
21      mechanical securement portion and to provide at least one  
22      adhering or adhesive securement portion for maintaining  
23      tab stability as the tab is assembled with the diaper and  
24      during tab storage on the diaper prior to tab deployment.

25 The mechanical securement portion includes a  
26 mechanical fastening user joint and the adhering  
27 securement portion includes a separation interface or  
28 separable bond portion that is separable to provide non-  
29 adhesive surfaces upon tab deployment to the fastening  
30 position. In the storage position, the separable bond  
31 portion is adhered together along the length of the tab  
32 to facilitate handling and assembly of the tab to a  
33 diaper. The deployment or opening movement of the tab to

1       the diaper fastening position causes separation of the  
2       separable bond portion.

3       In a first arrangement, the separable bond portion  
4       is provided by a transferable release system that enables  
5       the separation of an adhesive layer from an adjacent  
6       layer. Upon tab deployment to the diaper fastening  
7       position, the transferable release system includes a  
8       release coat that remains attached to the adhesive layer  
9       and masks the adhesive properties thereof. In this  
10      manner, the release coat covers the now exposed surface  
11      of the adhesive layer and effectively masks the adhesive  
12      properties thereof to cooperate in the provision of the  
13      non-adhesive exposed surfaces upon tab deployment.

14      In a second arrangement, the separable bond portion  
15      is provided by a non-pressure sensitive adhesive or  
16      cohesive. In this second arrangement, the non-pressure  
17      sensitive adhesive or cohesive is not tacky upon  
18      separation and it may remain with either the fastening  
19      element or the release element, or it may fracture or  
20      split between the two elements. Once again, non-adhesive  
21      surfaces are exposed upon tab deployment.

22      In a third arrangement, the separable bond portion  
23      is provided by separable or peelable films or film layers  
24      that releasably secure the adhering tab portions together  
25      along inner adjacent faces that form the separation  
26      interface. The separation interface may be opened to  
27      expose the two inner faces which provide non-adhesive  
28      separation surfaces. Additional film layers may be  
29      present, but the peelable films provide a divisible core  
30      formed by a pair of films of unlike polymers of different  
31      compositions. The core films are separably joined at the  
32      separation interface with sufficient strength to enable  
33      conventional processing of the diaper tab during tape  
34      manufacture, assembly of the tab to the diaper and during  
35      tab storage. Upon deployment of the tab for diaper

1       closure, the separation surfaces are "dry" and cleanly  
2       separate without either being tacky.

3       In each of the foregoing arrangements and  
4       embodiments, it should be appreciated that the separation  
5       interface or separable bond portion is formed by  
6       permanently combining or more strongly attaching adjacent  
7       layers to surfaces of the diaper. That is, the  
8       separation interface or separable bond requires  
9       supporting layers to be more strongly adhered or attached  
10      to support layers or substrates.

11      In the first and second arrangements, a central  
12      fingerlift, as defined more fully below, may be provided  
13      to facilitate proper layer separation and deployment of  
14      the tab during use. The central fingerlift is  
15      constructed to interact with the movement of the tab  
16      during deployment to assure proper separation of layers.  
17      The separation movement of the tab layers initially  
18      encounters the fingerlift prior to any required  
19      separation of adhesive or adhering interfaces of the tab.

20      The central fingerlift is not a fingerlift that is  
21      intended to be grasped to manipulate the tab, but rather,  
22      it comprises a combination of relative bond strengths  
23      between adjacent surfaces, and/or layer configurations  
24      and a separation or shear joint that enhances, if not  
25      assures, desired layer separation. The fingerlift is  
26      located between the mechanical and adhesive securement  
27      portions, and the separation or shear joint extends  
28      across the width of the adhesive securement portion. As  
29      the fastening element is separated for deployment, the  
30      proper separation of the adhesive securement portion is  
31      promoted by the fingerlift. The adhesion between the  
32      fastening element and the release element is typically  
33      less than the adhesion between the release element and  
34      the diaper. However, if adhesive joints between these  
35      elements are presented in a single plane across the

1 direction of separation movement of the fastening  
2 element, as would be the case in the absence of the  
3 fingerlift in accordance with the invention, the  
4 fastening element may remain bonded to the release  
5 element, and the latter may be stripped from the diaper  
6 during an improper release separation.

7 With respect to the direction of separation  
8 movement, the joint between the fastening element and the  
9 release element is recessed from the joint between the  
10 release element and the diaper by the fingerlift.  
11 Separation movement may be considered to freely travel to  
12 the joint between the fastening element and the release  
13 element, and to thereby bias the proper separation in the  
14 manner a "peel crack" or "crack back" facilitates  
15 separation of an adhesive label from a liner as compared  
16 with separation of the label at the liner edge. Also,  
17 the bond between the fastening element and securement  
18 portion may be stronger than the bond between the release  
19 element and the securement portion adjacent the  
20 separation joint.

21 In all of the illustrated embodiments and  
22 arrangements, the tab comprises a fastening element or  
23 tape secured to a release element or tape at least in  
24 part by the adhering or adhesive securement portion. As  
25 used herein, the adhesive or adhering securement portion  
26 may be formed of adhesives including pressure-sensitive  
27 adhesives, non-pressure sensitive adhesives including  
28 cohesives and separable polymeric films.

29

30 BRIEF DESCRIPTION OF THE DRAWINGS

31 FIG. 1 is a perspective view of a disposable diaper  
32 having a tab fastener in accordance with the invention;

33 FIG. 2 is a schematic sectional view on an enlarged  
34 scale of the tab fastener arranged in a flat condition,  
35 the plane of the section being perpendicular to the width

1       of the tab fastener and extending along the length  
2       thereof;

3           FIG. 3 is a fragmentary sectional view on an  
4       enlarged scale approximately along the line 3-3 of FIG.  
5       1;

6           FIG. 4 is a fragmentary sectional view on an  
7       enlarged scale approximately along the line 4-4 of FIG.  
8       1;

9           FIG. 5 is a schematic sectional view similar to Fig.  
10      2 showing a modified tab fastener that does not include a  
11      central fingerlift;

12          FIG. 6 is a fragmentary sectional view similar to  
13      FIG. 2 showing a tab fastener in accordance with a second  
14      embodiment of the invention, the tab being in a folded  
15      condition for winding in roll form;

16          FIG. 7 is a fragmentary sectional view showing the  
17      tab fastener of FIG. 6 in a storage position on a diaper;

18          FIG. 8 is a schematic sectional view showing the tab  
19      fastener of FIG. 6 in a deployed condition for diaper  
20      fastening;

21          FIG. 9 is a schematic view similar to FIG. 2 of  
22      another arrangement and a third embodiment of a tab  
23      fastener in accordance with the invention;

24          FIG. 9a is a fragmentary sectional view on an  
25      enlarged scale taken along the line 9a-9a in FIG. 9;

26          FIG. 9b is a sectional view similar to FIG. 9a  
27      showing a modification of the embodiment of FIG. 9;

28          FIG. 10 is a fragmentary sectional view similar to  
29      FIG. 3 showing the tab fastener of FIG. 9 in a stored  
30      condition on the diaper;

31          FIG. 11 is a fragmentary sectional view similar to  
32      FIG. 4 showing the tab fastener of FIG. 10 in a deployed  
33      condition for diaper fastening;

34          FIG. 12 is a fragmentary sectional view similar to  
35      FIG. 2 showing a tab fastener in accordance with another

1 arrangement and fourth embodiment of the invention, the  
2 tab being in a folded condition for winding in roll form;

3 FIG. 13 is a fragmentary sectional view showing the  
4 tab fastener of FIG. 12 in a storage position on a  
5 diaper; and

6 FIG. 14 is a schematic sectional view showing the  
7 tab fastener of FIG. 12 in a deployed condition for  
8 diaper fastening.

9                   DETAILED DESCRIPTION OF THE DRAWINGS

10                 Referring to FIG. 1, there is shown a disposable  
11 diaper 10 in accordance with the invention. The diaper  
12 10 comprises a laminate or layered assembly 12 having an  
13 inside surface 14 and an outside surface 16. The diaper  
14 10 is of generally rectangular configuration having a  
15 first end 18 and a second end 20 connected by  
16 longitudinally extending edges 22 and 24.

17                 The layered assembly 12 includes a liquid absorbent  
18 pad or batt core 26 enclosed within a liquid permeable  
19 inner shell or top sheet 28 and a liquid impermeable  
20 outer shell or backsheet 30. The core 26 may be of  
21 slightly smaller dimensions than the shells 26 and 28 so  
22 as to form a perimeter or border about the core 26.

23                 Referring to FIGS. 1 and 2, the diaper 10 includes  
24 tab or tape fastener assemblies 32 secured to the first  
25 end 18 of the diaper adjacent associated longitudinal  
26 edges 22 and 24. The tabs 32 are arranged to provide  
27 side closure of the diaper 10 about an infant upon  
28 engagement with landing member or zone 34. As described  
29 in further detail below, the tabs 32 and landing member  
30 34 provide mechanical closure of the diaper 10 through  
31 the use of complimentary engaging mechanical elements.

32                 The tab 32 has a multilayer construction including a  
33 fastening element or tape 36 having an outer face 38 and  
34 an opposed inner face 40. The fastening element 36 is

1       secured to a release element or tape 42 having an outer  
2       face 44 and an opposed inner face 46. The elements 36  
3       and 42 are secured together in lengthwise alignment and  
4       adjacency along their inner faces, and have substantially  
5       similar widths typical in diaper applications, e.g. 20 to  
6       40mm (0.8 to 1.6" ). The fastening element 36 is 62mm  
7       (2.44") and the release element 42 is 42mm (1.65") long  
8       in the illustrated tab 32.

9       The elongate dimensions of the elements 36 and 42  
10      are referred to as their length dimensions or directions  
11      herein, even though such dimensions or directions  
12      generally correspond with the width or cross machine  
13      direction of the films from which the elements are cut.  
14      Further, locations adjacent the diaper 10 are referred to  
15      as "proximal" and remote locations are designated  
16      "distal". Accordingly, element 36 has a proximal end 36a  
17      adjacent the diaper 10 and a distal end 36b remote of the  
18      diaper 10.

19      The fastening element 36 includes a fastening  
20      substrate or carrier 48 adjacent its outer face 38. The  
21      substrate 48 has an outer surface 48a and an opposed  
22      inner surface 48b. The substrate 48 may comprise a  
23      polymeric film of conventional diaper tab polymers such  
24      as polyethylene, polypropylene, blends and copolymers of  
25      polyethylene and polypropylene, and polyester, the latter  
26      enabling thinner gauge film to be used. Also, the  
27      fastening substrate 48 may be formed of a non-woven and  
28      polymer film laminate, the latter being of similar  
29      polymer materials as mentioned immediately above.  
30      Further, the fastening substrate 48 may be formed of  
31      paper based compositions such as K 080, sold by Kimberly-  
32      Clark Corporation of Neenah, Wisconsin.

33      The use of extensible or stretchable tabs to promote  
34      wearer comfort through better fit and more secure  
35      mounting is also known in the art. The tabs operate as

1 extensible diaper side waistbands. Examples of such  
2 diaper fastening systems are disclosed in US Patents  
3 4,795,456, 4,066,081, 4,051,853 and 3,800,796. To that  
4 end, the fastening element 36 may be formed of extensible  
5 materials as taught in US Patent 5,057,097 or a side-by-  
6 side coextrusion of extensible and non-extensible  
7 polymerid materials as disclosed in US Patent 3,800,796.

8 The fastening substrate 48 may be provided with a  
9 conventional release finish or coating to assure reliable  
10 self-winding of the stock to be used in making the tab.  
11 To that end, a silicone or carbamate release coating 49  
12 may be applied to the outer face 48a of the substrate 48.

13 The thickness of the fastening substrate 48 is not  
14 critical. Typical diaper tab substrate film thicknesses  
15 such as 4 mils (0.1mm) may be used.

16 For convenience, a fold line "F" shown in FIG. 2  
17 corresponds with the location or plane of folding of the  
18 tab 32 about an associated longitudinal edge 22 or 24 of  
19 the diaper 10. The plane of folding extends along the  
20 width of the tab 32 at substantially a right angle to the  
21 tab length.

22 The fastening element 36 includes first, second and  
23 third securement portions 50, 52 and 54 at its inner face  
24 40. The portion 50 is about 19mm (0.75") long, the  
25 portion 52 is about 15mm (0.47") long and the portion 54  
26 is about 12mm (0.47") long, the latter being spaced from  
27 the adjacent edge of the portion 52 by a distance of 8 to  
28 12mm (0.31 to 0.47").

29 In this embodiment, the securement portion 52 is a  
30 pressure-sensitive adhesive. Accordingly, the securement  
31 portions 50 and 52 comprise adhesive layers secured to  
32 the inner surface 48b of the substrate 48 for adhesive  
33 attachment to the inner face 46 of the release element 42  
34 as discussed more fully below.

1       The securement portion 54 comprises a mechanical  
2 fastening member including a mechanical engaging element  
3 such as a multiplicity of hooks 54b mounted on a base  
4 substrate 54c as diagrammatically shown in the drawings  
5 for engaging a complimentary mechanical engaging element  
6 such as loops 34a provided by the landing member 34. An  
7 example of a suitable mechanical engaging element is  
8 Ultramate 811 which is a high density polyethylene hook  
9 construction including a base sold by Velcro USA. Of  
10 course, other mechanical engaging systems may be used.  
11 Further, the securement portion 54 (and possibly the  
12 landing member 34) may provide both mechanical and  
13 adhesive attachment, the latter occurring intermediate  
14 the mechanical engaging elements as taught in US Patent  
15 4,946,527.

16      The securement portion 54 may be mounted to the  
17 surface 48b by any convenient means such as adhesives,  
18 welding, ultrasonic sealing or cold glue. Herein, the  
19 use of a pressure-sensitive adhesive is contemplated. In  
20 such case, the mechanical engaging member should have a  
21 length slightly less than that of the mounting pressure-  
22 sensitive adhesive and, if any overhang occurs, it should  
23 be at the downstream side of the direction of movement of  
24 the fastening element 36 during separation movement or to  
25 the left as shown in FIG. 2.

26      The mounting pressure-sensitive adhesive for the  
27 securement of the portion 54 may be applied to the  
28 substrate 48 by a tape supplier or film converter and the  
29 mechanical engaging member may be mounted to the adhesive  
30 by the diaper manufacturer or an intermediate third  
31 party. The subsequent assembly of the mechanical  
32 engaging member facilitates the provision of the tab in  
33 roll stock form since it may be more easily self-wound.  
34 The additional thickness of the engaging member, e.g. 16-  
35 40 mil (0.4-1 mm), tends to limit the roll length. It is

1       estimated that the added thickness reduces the manageable  
2       roll length from about 750m (820 yards) to about e.g.  
3       300m (328 yards).

4       The release element 42 includes a release substrate  
5       56 having a mounting surface 58 at its inner face 46 and  
6       an attachment portion 59 at its outer face 44. The  
7       substrate 56 should be substantially non-extensible and  
8       may comprise a polymeric film of conventional diaper tab  
9       polymers such as polyethylene, polypropylene, and blends  
10      and copolymers of polyethylene and polypropylene as well  
11      as polyester which allows thinner gauge film to be used.  
12      Also, the release substrate 56 may be formed of paper  
13      based compositions such as Bg 40, sold by Denayere, of  
14      Willebroek, Belgium.

15      The mounting surface 58 includes first and second  
16      mounting surface portions 60 and 62 for receiving  
17      securement portions 50 and 52, respectively, in adhesive  
18      contact. The mounting surface 58 also includes a third  
19      surface portion 64 remote of the portions 60 and 62.

20      The securement portion 50 and corresponding mounting  
21      surface portion 60 extend from the proximal end 36a of  
22      the element 36 and adjacent end of the element 42 to the  
23      location of the fold line "F" as shown in FIG. 2.  
24      Securement portion 52 and corresponding mounting surface  
25      portion 62 extend from the fold line "F" toward the  
26      distal end 36b of the element 36, but terminate together  
27      short of the end of the element 42. The third surface  
28      portion 64 corresponds in length with the space between  
29      the termination of the portion 52 and the end of the  
30      element 42. This spacing may be as small as 2mm (0.08").

31      As discussed above, the third surface portion 64 is  
32      provided by the termination of the securement portion 52  
33      to form a fingerlift 66 in this region including a  
34      separation joint 68. In addition to the separation joint  
35      68, the fingerlift 66 contemplates the relatively lower

1       peel strength of the adhesive bond between second portion  
2       52 and surface portion 62 as compared with the peel  
3       strength of the bond between the portion 52 and the  
4       adjacent surface 48b of the fastening element 36.

5       In addition to the selected relative peel strengths  
6       adjacent the portions 52 and 62, it is also desirable to  
7       provide non-adhesive, non-tacky exposed surfaces upon  
8       separation. To that end, the tab 32 includes a  
9       transferable release coat 70 that provides separation of  
10      the fastening tape 36 from the release tape 42 along a  
11      separation interface 72.

12      The release coat 70 is applied at least along the  
13      mounting surface portion 62 of the release tape 42 to an  
14      extent necessary to transfer to the securement portion 52  
15      and mask the adhesion characteristics thereof. For  
16      convenience of manufacture, the release coat 70 may also  
17      be applied along some or all of the mounting surface  
18      portion 64. In the illustrated embodiment, the release  
19      coat 70 extends across the full width of the release tape  
20      42 and along the length thereof extending from the fold  
21      line F to the distal end of the release tape 42.

22      As shown in Fig. 4, upon movement of the tab 32 for  
23      diaper closure, the release coat 70 breaks at the  
24      separation joint 68 with a first portion 70a remaining on  
25      the mounting surface portion 64 of the release tape 42  
26      and a second portion 70b separating with and remaining on  
27      the surface of the securement portion 52 of the fastening  
28      tape 36. In addition to the above described deployment  
29      advantages, the fingerlift 66 also promotes the breaking  
30      of the release coat 70 at the separation joint 68 and  
31      proper separation between the mounting surface portion 62  
32      and the adjacent surface of the release coat 70.

33      The fingerlift 66 cooperates with the release coat  
34      70 to provide the proper layer separation of the  
35      securement portion 52 from the release element 42 by the

1 provision of the separation joint 68 of relatively lower  
2 peel strength as the fastening element 36 is peeled from  
3 the release element 42. It should be appreciated further  
4 that the fingerlift 66 also provides a material savings  
5 due to the elimination of adhesive along the surface 64.

6 The fingerlift 66 extends across the entire width of  
7 the tab 32 and may have a length as short as 2mm (0.08").  
8 That is, it is only necessary that the fingerlift 66 be  
9 spaced at least about 2mm (0.08") from the edge of the  
10 element 42 and/or any adhesive forming the adjacent  
11 portion of the securement portion 54. The maximum length  
12 of the fingerlift 66 is determined by the required  
13 minimum length of the securement portion 52 to reliably  
14 maintain the elements 36 and 42 in alignment during tab  
15 processing and assembly to the diaper. Typically, the  
16 securement portion 52 length may be about 15mm (0.6") to  
17 reliably provide both of these functions.

18 The portions 50 and 52 may be conventional or known  
19 diaper tab adhesives such as acrylic or rubber based  
20 pressure-sensitive adhesives. Preferred adhesives  
21 include hot melt adhesives such as the adhesives taught  
22 in US Patent 3,932,328. The latter adhesives comprise an  
23 elastomeric component based on an elastomeric and  
24 thermoplastic A-B-A block copolymer wherein the A blocks  
25 are derived from styrene and the B blocks are derived  
26 from isoprene. The elastomeric component is blended with  
27 a combination of solid and liquid tackifiers.

28 The securement portions 50 and 52 may comprise the  
29 same adhesive or different adhesives. It is desirable  
30 that a strong permanent-type bond be formed between the  
31 fastening element 36 and the release element 42 at the  
32 proximal end of the tab 32 that is secured to the diaper  
33 10. To that end, an aggressive adhesive is favored for  
34 the securement portion 50, and, for example, a hot melt  
35 rubber based adhesive, a polyurethane adhesive or a two

1 component adhesive may be used to achieve a sufficiently  
2 strong bond. If a separate adhesive is used for the  
3 securement portion 52, a less aggressive adhesive can be  
4 used. For example, a less aggressive acrylic based  
5 adhesive or hot melt adhesive may be used.

6 As noted above, the release coat 70 is transferrable  
7 with the adhesive of the securement portion 52 and masks  
8 the adhesive properties thereof upon tab deployment.  
9 Typically, it has been found to be more efficient and  
10 economical to coat two pressure-sensitive adhesives,  
11 whether the same or different, to form the portions 50,  
12 52, and to mask the adhesive properties of the portion 52  
13 upon tab deployment using the transferrable release coat  
14 70.

15 A variety of resin or polymer compositions may be  
16 used to form the release coat 70 with solvent free  
17 formulations being preferred for environmental reasons.  
18 Particularly good results have been obtained with resins  
19 designed for a relatively high degree of volume shrinkage  
20 upon radiation cure. Highly acrylated resins having a  
21 relatively short backbone displaying limited flexibility  
22 have been found to result in stiff polymers displaying a  
23 degree of shrinkage that can not be absorbed by polymer  
24 tension forces. Such shrinkage is effective to weaken or  
25 destroy adhesion bonds at the interface between the resin  
26 and substrate and to thereby give rise to the  
27 transferable and breakable characteristics.

28 With these teachings in mind, suitable formulations  
29 may be derived for various adhesive and adjacent surface  
30 separation interfaces. Essentially, the release coat  
31 comprises a polymeric composition curable to form a  
32 release film having opposed surfaces. A first surface of  
33 the release coat or film is adhered to a non-adhesive  
34 layer (mounting surface portion 62) of the tab by wet  
35 bonding, e.g. bonding resulting from application of the

1        polymeric composition in a liquid state to the non-  
2        adhesive layer followed by curing of the polymeric  
3        composition. A second surface of the release film is  
4        adhered to an adhesive layer (e.g. securement portion 52)  
5        of the tab subsequent to the curing of the polymeric  
6        composition. The separation interface 72 is provided by  
7        the release film and non-adhesive layer and, upon tab  
8        deployment, the exposed non-adhesive surfaces are  
9        provided by the first surface of the release film and the  
10      adjacent surface of the non-adhesive layer. Routine  
11      experimentation will readily enable desired wet bonding  
12      strengths lower than those of the adhesive layer.

13       Examples of suitable resins for making the release  
14      coat 70 include acrylated polyurethane and/or polyester  
15      compositions. Suitable resin compositions are available  
16      from UCB Chemicals of Drogenbos, Belgium. For example,  
17      Ebecryl 220 is a mixture of 70% hexafunctional aromatic  
18      urethane acrylate and 30% pentaerythritol having tri- and  
19      tetra- acrylate functionality. The viscosity of Ebecryl  
20      220 may be reduced for coating purposes by combination  
21      with Ebecryl 160 which is a trimethylolpropane ethoxy  
22      triacrylate. Generally, the polyurethane and polyester  
23      components are blended in a weight ratio of 30:60 to  
24      60:30 to achieve a suitable processing viscosity.

25       If the release element 42, or more particularly the  
26      surface portion 62, has a high energy surface, or is  
27      provided with the same as by corona treatment, the resin  
28      compositions may be used with formulation to a suitable  
29      viscosity. If the release tape has relatively lower  
30      energy surface, an acrylated silicone component may be  
31      combined with the resin or resins to improve wetting of  
32      the tape surface. A suitable silicone based surface  
33      tension modifier is sold by Th. Goldschmidt of Essen,  
34      Germany under the designation RC 704. This is a highly

1 acrylated polydimethylsiloxane polymer, and it may be  
2 used in an amount ranging up to about 20% by weight.

3 The curing of the release coat 70 may be by electron  
4 beam ("EB") or ultra violet ("UV") radiation. In the  
5 case of the latter, an initiator may be included in the  
6 release coat. Irgacure 500 by Ciba Geigy may be used as  
7 a suitable photo-initiator comprising a 1:1 mixture of  
8 benzofenon and 1-hydroxycyclohexyl-phenyl-ketone. A  
9 typical amount of initiator is about 5% by weight.

10 In the case of a release tape 42 having a substrate  
11 56 formed of cast polypropylene, white color and corona  
12 treated up to 40 dynes/cm, e.g. PP-SK GLAT WEISS/cor 68  
13 micron sold by Rhenolit of Germany, a suitable release  
14 coating 70 is provided by a 60:40 blend of Ebecryl 220  
15 and Ebecryl 160 applied at a coating weight of from 1.0  
16 to 5.0 g/m<sup>2</sup>. In the case of a non-corona treated cast  
17 polypropylene, up to 15% by weight of the RC 704 may be  
18 added to the blend and similar coating weights may be  
19 used.

20 A biaxially oriented polypropylene film, white color  
21 and corona treated, 40-60 microns, may be suitably  
22 processed as described above at coating weights of from  
23 3.5 to 7.0 g/m<sup>2</sup>.

24 The resin blend forming the release coat 70 may be  
25 applied to the substrate 56 by known roll coating  
26 techniques such as a "5 roller" set-up using conventional  
27 equipment. If UV curing is to be used, inertization of  
28 the UV unit (nitrogen knife) is important. In the above  
29 examples, inertization of less than 50 ppm oxygen was  
30 maintained. The application of the liquid resin  
31 composition forming the release coat 70 will provide  
32 sufficient adhesion to the mounting surface portion 62  
33 and 64 of the substrate 56.

34 The resulting release coat 70 may be used in  
35 combination with conventional adhesives such as diaper

1       suitable pressure-sensitive adhesives for forming the  
2       securement portion 52. The pressure-sensitive adhesive  
3       may be acrylic or rubber based; preferred adhesives  
4       including hot melt adhesives as taught in US Patent  
5       3,932,328 as noted above.

6           The foregoing release coating and adhesive have been  
7       found to provide the desired separation between the  
8       surface of the substrate 56 of the release tape 42 and  
9       the release coat 70. That is, the release coat 70  
10      separates with the fastening tape 36 and covers the  
11      securement portion 52 which would otherwise be exposed  
12      for adhesive contact upon movement of the tab 100 to the  
13      diaper closure position.

14       The transferable release coat 70 simplifies the  
15      construction of the tab 32. As compared with a separate  
16      release liner such as a film or release liner insert, the  
17      release coat 70 provides the desired layer separation  
18      without a separate liner piece to be inserted during  
19      diaper manufacture and to be disposed of during diaper  
20      use.

21       The release coat 70 may be applied to the release  
22      tape 42 along the surface portion 62 and 64 using  
23      conventional coating, spraying or other techniques well  
24      known in the art. Thus, the release coat 70 also  
25      simplifies manufacture as compared with the use of a non-  
26      pressure sensitive adhesive or a cohesive. This is true  
27      since the tab 32 may be prepared using conventional web  
28      coating processes and techniques wherein pressure-  
29      sensitive adhesives are applied to the fastening tape 36  
30      and the release coat 70 is applied to the release tape  
31      42. In contrast, the use of non-adhesive or cohesives  
32      may involve compositions sufficiently different from  
33      typical pressure-sensitive adhesive compositions to  
34      prevent the use of conventional web processing equipment  
35      and techniques.

1 Referring to FIG. 3, the tab 32 is shown in the  
2 storage position folded along fold line "F" about the  
3 longitudinal edge 22 of the diaper 10. The attachment  
4 portion 59 adhesively secures the release element 42 to  
5 both the inside and outside surfaces 14, 16 of the diaper  
6 10, about equal lengths of the attachment portion 59  
7 being secured to each surface.

8 The fastening element 36 is secured to the release  
9 element 42 by securement portions 50 and 52. The  
10 adhesive bond between the securement portion 50 and the  
11 surface portion 60 is quite strong, effectively  
12 constituting a permanent bond in this environment. The  
13 adhesive bond between the securement portion 52 and the  
14 surface portion 62, or more particularly, the release  
15 coat 70, is adequate to maintain lengthwise alignment and  
16 control of the fastening element 36 including its distal  
17 end 36b during the diaper manufacture process and while  
18 the tab 32 is in the storage position. Thus, the present  
19 invention provides a material savings by reducing the  
20 length (and expanse) of the securement portion 52 without  
21 loss of lengthwise alignment and control thereof while  
22 also improving the reliability of the layer separation  
23 during deployment of the tab 32. Also, the adhesive  
24 properties of the portion 52 upon tab deployment are  
25 masked by the transferred release coat portion 70b.

26 Referring to FIG. 4, the tab 32 is shown in the  
27 deployed position ready for engagement with the landing  
28 member 34. A conventional fingerlift 74 may be provided  
29 in a known manner at the distal end 36b of the fastening  
30 element 36 to facilitate such deployment. As shown, the  
31 tab 32 forms a Y-bond type attachment with the diaper 10  
32 and the distal end 36b of the fastening element 36 is  
33 extended for attachment of the securement portion 54 to  
34 the landing member 34.

1           As illustrated in FIG. 4, the fastening element 36  
2   has been pulled from the storage position, "back-on-  
3   itself", in a lengthwise or separation direction. Such  
4   movement is essentially unopposed along the length of the  
5   surface portion 64 and fingerlift 66 until separation of  
6   the securement portion 52 from the surface portion 62 is  
7   required. At that point, the separation forces are  
8   imposed on the separation joint 68 which presents the  
9   least strong peel strength or adhesive bond resisting  
10   layer separation, and continued movement causes  
11   separation of the securement portion 52 together with  
12   release coat 70 from the surface portion 62.

13          At the end of the deployment separation movement,  
14   the securement portion 52 is substantially fully  
15   separated from the portion 62 at about the plane of the  
16   fold line "F" which also corresponds with the end of the  
17   release coat 70. The securement portion 52 is now  
18   covered by the transferred release coat portion 70b and  
19   no adhesive properties thereof are exposed.

20          The tab fastener of the present invention may be  
21   provided and used without the central fingerlift 66 as in  
22   the tab or tape assembly 32a as shown in FIG. 5. In this  
23   embodiment, similar components are identified with  
24   corresponding reference numerals.

25          In the tab 32a, securement portion 52a extends to  
26   the distal end of the release tape 42 so as to eliminate  
27   the fingerlift 66. Proper separation upon tab deployment  
28   is provided by the relative bond strengths between the  
29   adjacent surfaces of the portion 52a, the release coat 70  
30   and the mounting surface portion 62. Separation is  
31   achieved along the separation interface 72 and the entire  
32   expanse of the release coat 70 is transferred to the  
33   surface of the portion 52a.

34          The tab fastener of the present invention may be  
35   supplied to the diaper manufacturer in a number of

1 different configurations or stages of assembly. In all  
2 cases, conventional laminating, slitting and roll  
3 handling equipment may be used. Several supply  
4 configurations are discussed below.

5 The tab 32 is shown as a combined fastener system  
6 wherein the fastening element 36 and release element 42  
7 have been combined by a tape supplier or film converter.  
8 The tape supplier may also provide the securement portion  
9 54 in whole or in part. For example, the tape supplier  
10 may apply a suitable mounting adhesive at the location of  
11 the securement 54 and the diaper manufacturer or an  
12 intermediate third party may combine the particular  
13 mechanical fastening element as by adhering a first  
14 complimentary portion of a commercially available  
15 fastener Ultramate sold by Velcro USA. Of course the  
16 other complimentary portion of the fastener would be  
17 secured to the diaper backsheet or landing member.

18 It is also possible to supply the tab 32 as a two  
19 tape system consisting of the fastening element 36, with  
20 or without securement portion 54, and release element 42.  
21 Once again, the diaper manufacture or an intermediate  
22 third party may complete the mechanical fastener as  
23 described above. The elements 36 and 42 may be sold as  
24 separate but complete constructions, and the two tapes  
25 may be applied to the diaper by the diaper manufacturer  
26 using only conventional laminating and slitting roll  
27 processing equipment.

28 Referring to FIGS. 6, 7 and 8, a tab fastener 80 in  
29 accordance with a second embodiment is shown. For  
30 convenience of illustration, corresponding elements are  
31 similarly numbered with the addition of a prime  
32 designation. It should be understood that the assembly  
33 and proportions of the corresponding elements may vary  
34 slightly in each of the embodiments, but the essential  
35 functions of the elements are similar and the tab

1 fasteners similarly enjoy the improvements of the  
2 invention.

3       The tab fastener 80 is of conventional Y-bond  
4 construction providing separate tape attachments to the  
5 inside and outside of the diaper to form the factory  
6 bond. Referring to FIG. 6, the tab 80 is shown in its  
7 roll stock configuration, that is, the position of the  
8 elements forming the tab when wound in roll form as a  
9 precombined tab or tape system sold by a tape supplier or  
10 film converter. As shown, elements 36' and 42' are  
11 secured together. The tab 80 is applied to the  
12 longitudinal edge of the diaper 10 as shown in Fig. 7.  
13 To that end, the tab 80 includes a fastening element or  
14 tape 36' for engaging the outside surface 16 of the  
15 diaper 10 and a release tape 42' for engaging the inside  
16 surface 14 of the diaper 10. More particularly, the  
17 fastening element 36' includes a first securement portion  
18 50' adapted to engage the backsheet 30 of the diaper 10  
19 and the release element 42' includes an attachment  
20 portion 59' adapted to engage the top sheet 28 of the  
21 diaper 10. A small extent of the attachment portion 59'  
22 and the securement portion 50' engage with each other to  
23 secure the two elements together in the Y-bond  
24 configuration at the longitudinal edge 24 of the diaper  
25 10.

26       The fastening element 36' also includes a second  
27 securement portion 52' for engaging the release tape  
28 mounting surface portion 62'. The fastening element 36'  
29 further includes a third securement portion 54'  
30 comprising a mechanical engaging element such as a  
31 multiplicity of hooks 54b' mounted on a base substrate  
32 54c similar to the first tab embodiment described above.

33       The releasable engagement between the portion 52'  
34 and the mounting surface portion 62', or more  
35 specifically, the release coat 70', assures the stability

1       of the distal end 36b' of the substrate 36' during tab  
2       storage on the diaper 10. The release coat 70' assures  
3       that the bond strength between the securement portion 52'  
4       and the mounting surface 62' is less than that between  
5       the attachment portion 59' and the top sheet 28 of the  
6       diaper 10. More particularly, the release coat 70'  
7       provides a separation interface 72' between the portion  
8       62' and the release coat 70' so that the latter remains  
9       fixed to the portion 52' upon tab deployment.

10      The portion 52' extends towards the distal end 36b'  
11     of the element 36' and ends short of the securement  
12     portion 54'. As most clearly shown in FIG. 7, the  
13     securement portion 52' in the storage position extends  
14     along the mounting surface portion 62' and terminates at  
15     the mounting surface portion 64' to form a fingerlift 66'  
16     and a separation joint 68'. Accordingly, the securement  
17     portion 52' extends along the mounting surface portion of  
18     the element 42' and terminates at the adjacent surface  
19     portion 64' so that the latter is free of adhesive and  
20     attachment to the fastening element 36'. The fingerlift  
21     66' is similar in construction and operation to the  
22     fingerlift 66. Upon tab deployment as shown in Fig. 8,  
23     the release coat 70' breaks at separation joint 68'  
24     leaving release coat portion 70a' on the portion 64' of  
25     the release coat 42' and release coat portion 70b' on the  
26     securement portion 52' of the fastening tape 36'.

27      The fingerlift 66' also provides a material savings  
28     in respect to decreased amount of adhesive surface. In  
29     addition, the fingerlift 66' enables the length of the  
30     release element 42' to be decreased as compared to the  
31     length required in a similar tab construction not  
32     including a central fingerlift in accordance with the  
33     invention.

34      As in the first embodiment, the tab fastener 80 may  
35     be provided without a fingerlift 66' by extension of the

1 length of the increasing the length of the portion 52' or  
2 otherwise terminating the distal ends of the portion 52'  
3 and 62' in a common plane. The tab 80 may also be  
4 supplied to a diaper manufacturer as a two tape system  
5 comprising the completed elements 36' and 42'. The  
6 precombined or two tape systems may be supplied with or  
7 without the mechanical fasteners. In the latter case,  
8 the mechanical fasteners such as hooks may be secured to  
9 the tab by a diaper manufacturer or an intermediate third  
10 party.

11 Referring to FIGS. 9 and 9a, a tab fastener 90 in  
12 accordance with a third embodiment of the invention is  
13 shown. For convenience of illustration, corresponding  
14 elements are similarly numbered with the addition of a  
15 double prime (") designation.

16 The tab fastener 90 has a Y-bond construction  
17 similar to that of tab fastener 32 of the first  
18 embodiment. However, it should be understood that  
19 separate tape attachments to the inside and outside of  
20 the diaper to form the factory bond may be used as shown  
21 in the tab fastener 80.

22 The tab 90 includes a fastening element or tape 36''  
23 having an outer face 38'' and an inner face 40''. The  
24 element 36'' is secured to a release tape 42'' having an  
25 outer face 44'' and an inner face 46''. The elements  
26 36'' and 42'' are secured together in lengthwise  
27 alignment and adjacency along their inner faces, and have  
28 similar widths as described above in connection with the  
29 first embodiment.

30 The fastening element 36'' includes a fastening  
31 substrate or carrier 48'' adjacent its outer face 38''.  
32 The substrate 48'' has an outer surface 48a'' and an  
33 opposed inner surface 48b''. The substrate 48'' may be  
34 provided with a release finish or coating 49'' to assure

1 reliable self-winding of the stock to be used in making  
2 the tab.

3 For convenience, a fold line "F" shown in FIG. 9  
4 corresponds with the location or plane of folding of the  
5 tab 90 about an associated longitudinal edge 22 or 24 of  
6 the diaper 10. The plane of folding extends along the  
7 width of the tab 90 at substantially a right angle to the  
8 tab length.

9 The fastening element 36'' includes first, second  
10 and third securement portions 50'', 52'' and 54'' at its  
11 inner face 40''. The portions 50'' and 54'' are similar  
12 to the portions 50 and 54, respectively, as described in  
13 connection with the tab 32 of the first embodiment. The  
14 portion 52'' is similar to the portion 52 in that it also  
15 maintains the alignment of the elements of the tab 90  
16 during diaper assembly and while the tab is in the  
17 storage condition.

18 The release element 42'' includes a release  
19 substrate 56'' having a mounting surface 58'' at its  
20 inner face 46'' and an attachment portion 59'' at its  
21 outer face 44''. The attachment portion 59'' mounts the  
22 tab 90 to the diaper 10 in the storage position as shown  
23 in FIG. 10. The release element 42'' generally  
24 corresponds with the element 42 described above.  
25 However, the release coat 70 is not required and such has  
26 been omitted herein since the securement portion 52'' is  
27 not a pressure-sensitive adhesive.

28 The mounting surface 58'' includes first and second  
29 mounting surface portions 60'' and 62'' for receiving  
30 securement portions 50'' and 52'', respectively, in  
31 adhesive contact. The mounting surface 58'' also  
32 includes a third surface portion 64'' remote of the  
33 portions 60'' and 62''.

34 The securement portion 50'' and associated mounting  
35 surface portion 60'' are similar to the corresponding

1       elements in the tab 32. In the tab fastener 90, the  
2       securement portion 52'' comprises one or more stripes or  
3       drops of adhesive located adjacent the distal side of the  
4       fold line "F". The corresponding mounting surface  
5       portion 62'' may extend from the fold line "F" toward the  
6       distal end 36b'' of the element 36'' and at least  
7       corresponds in length with the major length dimension or  
8       extent of the stripe or drop shaped securement portion  
9       52''.

10      The portion 52'' comprises a single stripe of  
11     adhesive having a thickness about equal to the thickness  
12     of the portion 50''. As determined by the preferences of  
13     the diaper manufacturer, the width of the portion 52''  
14     may be equal to from about 1mm (0.04") to about the width  
15     of the fastening element 36''. The length of the portion  
16     52'' may be equal to from about 1mm (0.04") to the length  
17     of the release element 42" on the distal side of the fold  
18     line F less about 2mm (0.08") to allow for the surface  
19     portion 64''. The same dimensional considerations also  
20     apply to the overall size of the portion 52'' when it is  
21     formed of two or more stripes or drops of adhesive.

22      As in the first embodiment, the securement portion  
23     52'' is spaced from or terminates short of the end of the  
24     element 42''. The third surface portion 64'' corresponds  
25     in length with the space between the termination of the  
26     portion 52'' and the end of the element 42''. This  
27     spacing may be as small as 2mm (0.08").

28      The cross-section of the stripe configuration of the  
29     securement portion 52'' is shown in FIG. 9a. As noted  
30     above, the securement portion 52'' may be provided in a  
31     drop or dollop configuration as shown in FIG. 9b.

32      As discussed above, the third surface portion 64''  
33     is provided by the termination of the securement portion  
34     52'' to form a fingerlift 66'' in this region including a  
35     separation joint 68''. In addition to the separation

1 joint 68'', the fingerlift 66'' contemplates the  
2 relatively lower peel strength of the adhesive bond  
3 between second portion 52'' and surface portion 62'' as  
4 compared with the peel strength of the bond between the  
5 portion 52'' and the adjacent surface 48b'' of the  
6 fastening element 36''. Accordingly, a release coating  
7 or an adhesive detackifier or deadening agent can be used  
8 between the adjacent faces of the portion 52'' and the  
9 adjacent surface 62''. The fingerlifts 66'' and 66  
10 operate in similar manners.

11 The securement portion 52'' may be a non-pressure  
12 sensitive adhesive or a cohesive suitable for use in a  
13 diaper tab. The adhesive or cohesive should be easily  
14 applied and result in a bond sufficient to maintain the  
15 elements 36'' and 42'' aligned in their adhered position  
16 during diaper manufacture and during tab storage on the  
17 diaper prior to deployment for diaper closure. It is  
18 also necessary that the adhesive or cohesive be separable  
19 from at least one of the adjacent surfaces (e.g. 62'') or  
20 fracture by the deployment movement within the  
21 requirements of the fingerlift 66''. Herein, a  
22 separation interface 72'' is provided between the surface  
23 portion 62'' and the portion 52''.

24 The non-pressure sensitive adhesive or cohesive of  
25 the portion 52'' may be applied to the tab 90 using  
26 conventional solvent or hot techniques, e.g., by use of a  
27 hot melt nozzle, a hot melt die or a roll coater. Useful  
28 non-pressure sensitive adhesives include hot melt  
29 adhesives based on polyolefin resins and cold seal  
30 adhesives applied from a solvent. A commercially  
31 available suitable hot melt adhesive is sold with the  
32 designation Crodamelt by the Croda company in Kapellen,  
33 Belgium. Suitable cohesives are disclosed in U.S. Patent  
34 5,085,655. Since the cohesive is applied hot or in  
35 solvent form, it bonds with the mounting surfaces 62'' of

1       the release element 42'' and the inner surface 48b'' of  
2       the fastening element 36''. After the bond is broken  
3       during tab deployment, the cohesive coheres to itself,  
4       but does not adhere to other materials.

5       Following deployment of the tab fastener 90 to the  
6       diaper closure position as shown in FIG. 11, the  
7       separated or exposed surface of the portion 52'' is a  
8       non-pressure sensitive, not tacky, and does not provide  
9       adhesive closure with the diaper. As noted above, the  
10      portion 52'' is formed of a non-pressure-sensitive  
11      adhesive and, after its adhesive bond with the surface  
12      62'' is broken during tab deployment, the exposed surface  
13      of the portion 52'' does not provide a further adhesive  
14      bond as in the case of the portion 52.

15      As shown in FIG. 11, the mounting surface portion  
16      62'' of the release element 42'' may include a  
17      conventional or non-transferrable release coat (e.g. a  
18      silicone or carbamate coat extending along its surface,  
19      not shown) and the securement portion 52'' remains on the  
20      fastening element 36'' upon tab deployment. However, it  
21      is not necessary to use such a release coat on the  
22      mounting surface portion 62'' and, upon tab deployment,  
23      the non-pressure sensitive adhesive or the cohesive  
24      portion 52'' may remain with either of the elements 36''  
25      and 42'' depending upon the surfaces of the elements or  
26      fracture with parts of the portion 52'' remaining on each  
27      of the elements.

28      Referring to Figs. 12, 13 and 14, a tab or tape  
29      fastener 100 in accordance with a fourth embodiment of  
30      the invention is shown. The construction of the tab 100  
31      is similar to that of the tab 80 shown in Figs. 6-8 and  
32      includes a corresponding fastening element or tape 36'.  
33      For convenience, like reference numerals are used in  
34      connection with like parts in the two embodiments.

1           The tab 100 includes a release element or tape 102  
2       having an outer face 104 and an inner face 106. The  
3       elements 36' and 102 are secured together in lengthwise  
4       alignment and adjacency along their inner faces.  
5       Further, the elements 36' and 102 have substantially  
6       similar widths typical in diaper applications, e.g. 20 to  
7       40mm (0.8 to 1.6" ). The fastening element 36' is 62mm  
8       (2.44") and the release element 102 is 42mm (1.65") long  
9       in the illustrated tab 100.

10       The release element 102 includes a pair of  
11      releasably joined film layers comprising a release  
12      substrate 108 releasably secured to a separable film 110  
13      along a separation interface 112. The substrate 108 and  
14      film 110 cooperate to form a divisible core that may be  
15      separated along interface 112. As described in detail  
16      below, the separable film 110 operates to mask or deaden  
17      the adhesive the adhesive surface of the securement  
18      portion 52' of the fastening tape 36' in the same manner  
19      as the release coat 70' in the tab 80.

20       The tab fastener 100 is of conventional Y-bond  
21      construction providing separate tape attachments to the  
22      inside and outside of the diaper to form the factory  
23      bond. To that end, the fastening tape 36' is arranged to  
24      engage the outside surface 16 of the diaper 10 and the  
25      release element 102 is arranged to engage the inside  
26      surface 14 of the diaper 10. More particularly, the  
27      fastening element 36' includes a first securement portion  
28      50' adapted to engage the backsheet 30 of the diaper 10  
29      and the release element 102' includes an attachment  
30      portion 114 adapted to engage the top sheet 28 of the  
31      diaper 10. A small extent of the attachment portion 114  
32      and the securement portion 50' engage with each other to  
33      secure the two elements together in the Y-bond  
34      configuration at the longitudinal edge 22 or 24 of the  
35      diaper 10.

1       The fastening element 36' also includes a second  
2       securement portion 52' for engaging the release tape  
3       mounting surface portion 116. In this embodiment, the  
4       release element 102 ends at the distal extremity of the  
5       securement portion 52'. A separation joint 118 is  
6       provided by the exposed or distal edge of the separation  
7       interface 112, and the distal ends or extremities of the  
8       release element 102 including the release substrate 108  
9       and the separable film 110 together with the distal end  
10      of the securement portion 52' are in a common plane with  
11      the separation joint 118.

12      The release substrate 108 and separable film 110 may  
13      be extruded together with the formation of separation  
14      interface 112 therebetween as taught in US Patent  
15      4,925,714, also owned by the assignee herein. Upon  
16      separation along the interface 112, the exposed surfaces  
17      are "dry" and cleanly separate without either being  
18      tacky.

19      Suitable polymer extrudates for the substrate 108  
20      and film 110 include polyethylene and polypropylene. The  
21      interfacial peel strength at the interface 112 is a  
22      function of several parameters, including, among others,  
23      the identities of the two dissimilar thermoplastic  
24      layers, the presence or absence of pigments in one or  
25      both films, the pressure exerted by, and the temperature  
26      of, the nip rollers, and thermal aging of the coextruded  
27      layers. While several factors can play a role in  
28      providing a desired peel strength, that desired peel  
29      strength can be achieved through routine experimentation.  
30      Peel strengths of less than about 50 newtons/meter are  
31      possible using this technique, and preferred peel  
32      strengths are in the range of from about 30 to 200  
33      newtons/meter.

34      The adhesive compositions to which the substrate 108  
35      and the film 110 are secured should have peel strengths

1 exceeding those of the interfacial peel strength along  
2 the separation interface 112. Suitable adhesives  
3 including those mentioned above and/or described in US  
4 Patent 4,925,714 may exhibit an adhesive force of about  
5 15 to about 50 ounces per inch (about 170 to about 560  
6 g/cm) of adhesive width in the 180° peel adhesive test of  
7 the P.S.T.C. test #1, with a 20 minute dwell time. More  
8 preferably, the peel strength is about 20 to about 45  
9 ounces per inch (about 220 to about 450 g/cm).

10 As particularly shown in Fig. 14, deployment of the  
11 tab 100 to the diaper closure position causes separation  
12 along the separation interface 112 with exposure of  
13 surface 110a of the separable film 110 and surface 108a  
14 of the substrate 108. The surfaces 110a and 108a are dry  
15 and do not display tackiness.

16 In the preparation of the tabs or tapes of the  
17 present invention, the adhesive layers such as the  
18 securement and attachment portions may be applied to  
19 suitable substrate materials using extrusion coating, die  
20 coating and/or roll coating techniques as well as the hot  
21 melt nozzle technique noted above for the portion 52''.  
22 The adhesive layers may be of conventional diaper tab  
23 thickness, such as about 30 microns (0.1 mil) thick, and  
24 extend across the full width of the substrate of the tab  
25 or tape and may be in the form of one or more stripes or  
26 drops as used in the portion 52''. The tabs may be  
27 formed of adhesive coated film or stock materials using  
28 known laminating and slitting techniques. The separable  
29 or peelable film constructions shown in connection with  
30 the tab 100 may be made using coextrusion techniques and  
31 multi-manifold dies as described in US Patents 4,197,069  
32 and 4,152,387.

33 The invention is not restricted to the slavish  
34 imitation of each and every detail set forth above.  
35 Obviously, devices may be provided which change,

- 1      eliminate, or add certain specific details without
- 2      departing from the invention.

WHAT IS CLAIMED IS:

- 1        1. A diaper having fastening tabs that each include multiple layers, the tab being movable from a storage position on the diaper to a deployed position for diaper closure,
- 5        said diaper including a layered assembly having inside and outside major surfaces extending between a first end and a second end and connected by longitudinal edges, one of said tabs being secured to said diaper at each longitudinal edge adjacent said first end, said diaper also including a landing zone on said outside surface at said second end of said diaper,
- 12        each of said tabs including a fastening element and a release element, said fastening and release elements each having a length and being adapted to be disposed in close adjacency and alignment along their lengths in said storage position,
- 17        said fastening element including at least one securement portion extending along its length for securing the fastening element to the release element in the storage position,
- 21        said release element including at least one mounting surface for receiving said at least one securement portion and cooperating therewith to form a separation interface, said tab layers being separable along said separation interface upon tab deployment for diaper closure,
- 27        movement of said tab to said deployed position including peeling said fastening element from said release element in a lengthwise direction along said at least one securement portion and separating said fastening element from said release element along said separation interface to expose opposed non-adhesive surfaces.

1           2. A diaper as in claim 1, wherein said tab  
2 includes a transferable release coat for providing said  
3 separation interface, said release coat cooperating with  
4 said at least one securement portion and said at least  
5 one mounting surface to secure said fastening element to  
6 said release element in the storage position.

1           3. A diaper as in claim 2, wherein said release  
2 coat comprises a polymeric composition curable to form a  
3 release film having opposed surfaces, a first surface of  
4 said release film being adhered to a non-adhesive layer  
5 of said tab by wet bonding resulting from application of  
6 the polymeric composition in a liquid state to the non-  
7 adhesive layer followed by curing of the polymeric  
8 composition, and a second surface of said release film  
9 being adhered to an adhesive layer of said tab subsequent  
10 to the curing of said polymeric composition, said  
11 separation interface being provided by said release film  
12 and said non-adhesive layer and said exposed non-adhesive  
13 surfaces being provided by said first surface of said  
14 release film and an adjacent surface of said non-adhesive  
15 layer upon deployment of said tab.

1           4. A diaper as in claim 3, wherein said polymeric  
2 composition shrinks to a sufficient degree upon curing to  
3 cause the peel strength of the wet bonding to said non-  
4 adhesive surface to be less than the peel strength of  
5 said second surface to said adhesive layer.

1           5. A diaper as in claim 4, wherein said polymeric  
2 composition comprises an acrylated polyurethane resin.

1           6. A diaper as in claim 4, wherein said polymeric  
2 composition comprises a blend of an acrylated  
3 polyurethane resin and an acrylated polyester resin, said

4        polyurethane and polyester resins being blended in a  
5        weight ratio of 30:60 to 60:30.

1            7. A diaper as in claim 6, wherein said acrylated  
2        polyurethane resin is a mixture of 70% hexafunctional  
3        aromatic urethane acrylate and 30% pentaerythritol having  
4        tri- and tetra- acrylate functionality, and said  
5        acrylated polyester resin is a trimethylolpropane ethoxy  
6        triacrylate.

1            8. A diaper as in claim 2, wherein said release  
2        coat separates from said at least one mounting surface of  
3        said release element and remains fixed to said at least  
4        one mounting portion of said fastening element upon tab  
5        deployment, said mounting portion comprises a pressure-  
6        sensitive adhesive and said release coat masks the  
7        adhesive properties of said pressure-sensitive adhesive.

1            9. A diaper as in claim 2, wherein said fastening  
2        element is bonded to said release element by said at  
3        least one securement portion with a first bond strength  
4        between said fastening element and securement portion and  
5        a second bond strength between said at least one mounting  
6        surface and said securement portion, said bond strengths  
7        being of sufficient strength to maintain said fastening  
8        and release elements in said close adjacency and  
9        alignment during assembly of said fastening tabs to said  
10      diaper and during storage of said fastening tab in said  
11      storage position.

1            10. A diaper as in claim 1, wherein said at least  
2        one securement portion comprises a non-pressure sensitive  
3        adhesive layer or a cohesive layer joined to said at  
4        least one mounting surface to secure said fastening  
5        element to said release element in the storage position,

6        said non-pressure sensitive adhesive or cohesive layer  
7        cooperating with said at least one mounting surface to  
8        provide said separation interface.

1            11. A diaper as in claim 10, wherein said non-  
2        pressure sensitive adhesive or cohesive layer includes a  
3        first surface adhered to mounting surface of said release  
4        element, and said non-pressure sensitive adhesive or  
5        cohesive layer first surface and said at least one  
6        mounting surface cooperating to provide said exposed non-  
7        adhesive surfaces upon tab deployment.

1            12. A diaper as in claim 10, wherein said at least  
2        one securement portion upon deployment of said fastening  
3        element remains bonded to said fastening element, remains  
4        bonded to said release element or fractures with separate  
5        parts thereof remaining bonded to said fastening element  
6        and to said release element.

1            13. A diaper as in claims 1 or 10, further  
2        including a central fingerlift to enhance layer  
3        separation, said release element including said at least  
4        one mounting portion and an adjacent surface portion that  
5        is free of said securement portion and substantially  
6        unattached to said fastening element, said at least one  
7        securement portion terminating at a separation joint to  
8        form said fingerlift with said adjacent mounting surface  
9        portion, movement of said tab to said deployed position  
10      also including peeling said fastening element from said  
11      release element in said lengthwise direction across said  
12      adjacent surface portion.

1            14. A diaper as in claim 13, wherein said fastening  
2        element has a proximal end permanently secured to said  
3        diaper and extends lengthwise to a distal end adapted to

4       carry a mechanical means for closing the diaper in a user  
5       joint, said at least one securement portion being located  
6       remote of the proximal end of said fastening element,  
7       said mechanical means being located at the distal end of  
8       said fastening element and said central fingerlift being  
9       located at a lengthwise intermediate location between  
10      said at least one securement portion and said mechanical  
11      means.

1           15. A diaper as in claim 14, wherein said release  
2       element includes an attachment portion on a side thereof  
3       remote of said mounting surface, and said release element  
4       is folded about an associated one of said longitudinal  
5       edges of said diaper and secured by said attachment  
6       portion to said inside and outside surfaces of said  
7       diaper.

1           16. A diaper as in claim 15, wherein said  
2       mechanical means comprise a plurality of hook fasteners  
3       respectively secured to each of said tabs.

1           17. A diaper as in claim 15, wherein said fastening  
2       element comprises a substrate film selected from the  
3       group consisting of polymeric film, paper and non-woven  
4       laminated to polymeric film.

1           18. A diaper as in claim 1, wherein said tab  
2       includes first and second film layers having remote outer  
3       faces and adjacent inner faces releasably joined together  
4       along said separation interface, said film layer outer  
5       faces being respectively secured to said fastening and  
6       release elements, and, upon tab deployment, said inner  
7       faces providing said non-adhesive surfaces.

1           19. A diaper as in claim 18, wherein said first and  
2       second film layers are formed of unlike polymers.

1           20. A diaper as in claim 18, wherein said first and  
2       second film layers are formed of film forming polymers  
3       selected from the group consisting of polyethylene and  
4       polypropylene.

1           21. A diaper having fastening tabs that each  
2       include multiple layers, said tab being movable from a  
3       storage position on the diaper to a deployed position for  
4       diaper closure,

5           said diaper including a layered assembly having  
6       inside and outside major surfaces extending between a  
7       first end and a second end and connected by longitudinal  
8       edges, one of said tabs being secured to said diaper at  
9       each longitudinal edge adjacent said first end, said  
10      diaper also including a landing zone on said outside  
11      surface at said second end of said diaper,

12        each of said tabs including a fastening element and  
13       a release element, each of said elements having a length  
14       and opposed faces including an inner face and an outer  
15       face, said inner faces of said elements being disposed in  
16       close adjacency and alignment along the lengths of the  
17       elements,

18        said fastening element inner face including first  
19       and second securement portions disposed along its length  
20       for securing the fastening element to said inner face of  
21       said release element in the storage position and a third  
22       securement portion for diaper closure in the deployed  
23       position, said third securement portion comprising a  
24       first mechanical fastening element for engagement with a  
25       second mechanical element provided by said landing zone,

26        said release element inner face including a mounting  
27       surface having first and second mounting portions for

28      respectively receiving said first and second securement  
29      portions of said fastening element, said release element  
30      outer face including an attachment portion for securing  
31      said tab to the diaper,

32      said first and second securement portions engaging  
33      said first and second mounting portions of said mounting  
34      surface for securing said fastening element to said  
35      release element during assembly of the tab with the  
36      diaper and for maintaining said fastening element and  
37      release element in lengthwise adjacency while said tab is  
38      in said storage position on the diaper,

39      said second securement and mounting portions  
40      cooperating to form a separation interface, said tab  
41      layers being separable along said separation interface  
42      upon tab deployment for diaper closure,

43      movement of said tab to said deployed position for  
44      diaper closure including peeling said fastening element  
45      from said release element in a lengthwise separation  
46      direction along said second securement portion and  
47      separating said fastening element from said release  
48      element along said separation interface to expose non-  
49      adhesive surfaces.

1                22. A diaper as in claim 21, wherein said fastening  
2      element is bonded to said release element by said second  
3      securement portion with a first bond strength between  
4      said fastening element and second securement portion and  
5      a second bond strength between said second mounting  
6      surface and said second securement portion, said bond  
7      strengths being of sufficient strength to maintain said  
8      fastening and release elements in said close adjacency  
9      and alignment during assembly of said fastening tabs to  
10     said diaper and during storage of said fastening tab in  
11     said storage position.

1           23. A diaper as in claim 22, wherein said first  
2 bond strength is greater than said second bond strength.

1           24. A diaper as in claim 21, wherein said fastening  
2 element has a proximal end permanently secured to said  
3 diaper and extends lengthwise to a distal end adapted to  
4 be secured to said diaper by engagement of said first and  
5 second mechanical fastening elements during diaper  
6 closure, said first portion being located at the proximal  
7 end of said fastening element and said third securement  
8 portion being located at the distal end of said fastening  
9 element with said second securement portion therebetween,  
10 and said central fingerlift being located at a lengthwise  
11 intermediate location between said second and third  
12 securement portions.

1           25. A diaper as in claim 21, wherein said tab  
2 includes a transferable release coat for providing said  
3 separation interface, said release coat cooperating with  
4 said second securement portion and said second mounting  
5 surface to secure said fastening element to said release  
6 element in the storage position.

1           26. A diaper as in claim 25, wherein said release  
2 coat comprises a polymeric composition curable to form a  
3 release film having opposed surfaces, a first surface of  
4 said release film being adhered to said second mounting  
5 surface portion of said release element by wet bonding  
6 resulting from application of the polymeric composition  
7 in a liquid state to the non-adhesive layer followed by  
8 curing of the polymeric composition, and a second surface  
9 of said release film being adhered to an adhesive layer  
10 of said second mounting portion of said fastening element  
11 subsequent to the curing of said polymeric composition,  
12 said separation interface being provided by said release

13       film and said second mounting surface portion of said  
14      release element and said exposed non-adhesive surfaces  
15      being provided by said first surface of said release film  
16      and said second mounting surface portion of said release  
17      element upon deployment of said tab.

1           27. : A diaper as in claim 26, wherein said polymeric  
2      composition shrinks to a sufficient degree upon curing to  
3      cause the peel strength of the wet bonding to said second  
4      mounting surface portion of said release element to be  
5      less than the peel strength of said second surface of  
6      said release film to said adhesive layer of said second  
7      mounting surface portion of said release element.

1           28. A diaper as in claim 21, wherein said second  
2      securement portion comprises a non-pressure sensitive  
3      adhesive or cohesive layer joined to said second mounting  
4      surface to secure said fastening element to said release  
5      element in the storage position, said non-pressure  
6      sensitive adhesive or cohesive layer cooperating with  
7      said second mounting surface to provide said separation  
8      interface.

1           29. A diaper as in claims 21 or 28, further  
2      including a central fingerlift to enhance layer  
3      separation, said release element including said second  
4      mounting portion and an adjacent surface portion that is  
5      free of said securement portion and substantially  
6      unattached to said fastening element, said second  
7      securement portion terminating at a separation joint to  
8      form said fingerlift with said adjacent mounting surface  
9      portion, movement of said tab to said deployed position  
10     also including peeling said fastening element from said  
11     release element in said lengthwise direction across said  
12     adjacent surface portion.

1           30. A diaper as in claim 21, wherein said tab  
2 includes first and second film layers having remote outer  
3 faces and adjacent inner faces releasably joined together  
4 along said separation interface, said film layer outer  
5 faces being respectively secured to said fastening and  
6 release elements, and, upon tab deployment, said inner  
7 faces providing said non-adhesive surfaces.

1           31. A fastener tab for use in closure of a diaper,  
2 said fastener tab comprising multiple layers, said tab  
3 being movable from a storage position on the diaper to a  
4 deployed position for diaper closure,

5           said tab comprising a fastening element and a  
6 release element, said fastening and release elements each  
7 having a length and being adapted to be disposed in close  
8 adjacency and alignment along their lengths in said  
9 storage position,

10          said fastening element including at least one  
11 securement portion extending along its length for  
12 securing the fastening element to the release element in  
13 the storage position,

14          said release element including at least one mounting  
15 surface for receiving said at least one securement  
16 portion and cooperating therewith to form a separation  
17 interface, said tab layers being separable along said  
18 separation interface upon tab deployment for diaper  
19 closure,

20          movement of said tab to said deployed position  
21 including peeling said fastening element from said  
22 release element in a lengthwise direction along said at  
23 least one securement portion and separating said  
24 fastening element from said release element along said  
25 separation interface to expose opposed non-adhesive  
26 surfaces.

1           32. A diaper as in claim 31, wherein said tab  
2 includes a transferable release coat for providing said  
3 separation interface, said release coat cooperating with  
4 said at least one securement portion and said at least  
5 one mounting surface to secure said fastening element to  
6 said release element in the storage position.

1           33. A diaper as in claim 32, wherein said release  
2 coat comprises a polymeric composition curable to form a  
3 release film having opposed surfaces, a first surface of  
4 said release film being adhered to a non-adhesive layer  
5 of said tab by wet bonding resulting from application of  
6 the polymeric composition in a liquid state to the non-  
7 adhesive layer followed by curing of the polymeric  
8 composition, and a second surface of said release film  
9 being adhered to an adhesive layer of said tab subsequent  
10 to the curing of said polymeric composition, said  
11 separation interface being provided by said release film  
12 and said non-adhesive layer and said exposed non-adhesive  
13 surfaces being provided by said first surface of said  
14 release film and an adjacent surface of said non-adhesive  
15 layer upon deployment of said tab.

1           34. A diaper as in claim 33, wherein said  
2 polymeric composition comprises a blend of an acrylated  
3 polyurethane resin and an acrylated polyester resin, said  
4 polyurethane and polyester resins being blended in a  
5 weight ratio of 30:60 to 60:30.

1           35. A diaper as in claim 34, wherein said acrylated  
2 polyurethane resin is a mixture of 70% hexafunctional  
3 aromatic urethane acrylate and 30% pentaerythritol having  
4 tri- and tetra- acrylate functionality, and said

5       acrylated polyester resin is a trimethylolpropane ethoxy  
6       triacrylate.

1           36. A diaper as in claim 32, wherein said release  
2       coat separates from said at least one mounting surface of  
3       said release element and remains fixed to said at least  
4       one mounting portion of said fastening element upon tab  
5       deployment, said mounting portion comprises a pressure-  
6       sensitive adhesive and said release coat masks the  
7       adhesive properties of said pressure-sensitive adhesive.

1           37. A diaper as in claim 32, wherein said fastening  
2       element is bonded to said release element by said at  
3       least one securement portion with a first bond strength  
4       between said fastening element and securement portion and  
5       a second bond strength between said at least one mounting  
6       surface and said securement portion, said bond strengths  
7       being of sufficient strength to maintain said fastening  
8       and release elements in said close adjacency and  
9       alignment during assembly of said fastening tabs to said  
10      diaper and during storage of said fastening tab in said  
11      storage position.

1           38. A diaper as in claim 31, wherein said at least  
2       one securement portion comprises a non-pressure sensitive  
3       adhesive or cohesive layer joined to said at least one  
4       mounting surface to secure said fastening element to said  
5       release element in the storage position, said non-  
6       pressure sensitive adhesive or cohesive layer cooperating  
7       with said at least one mounting surface to provide said  
8       separation interface.

1           39. A diaper as in claims 31 or 38, further  
2       including a central fingerlift to enhance layer  
3       separation, said release element including said at least

4        one mounting portion and an adjacent surface portion that  
5        is free of said securement portion and substantially  
6        unattached to said fastening element, said at least one  
7        securement portion terminating at a separation joint to  
8        form said fingerlift with said adjacent mounting surface  
9        portion, movement of said tab to said deployed position  
10      also including peeling said fastening element from said  
11      release element in said lengthwise direction across said  
12      adjacent surface portion.

1            40. A diaper as in claim 31, wherein said tab  
2        includes first and second film layers having remote outer  
3        faces and adjacent inner faces releasably joined together  
4        along said separation interface, said film layer outer  
5        faces being respectively secured to said fastening and  
6        release elements, and, upon tab deployment, said inner  
7        faces providing said non-adhesive surfaces.

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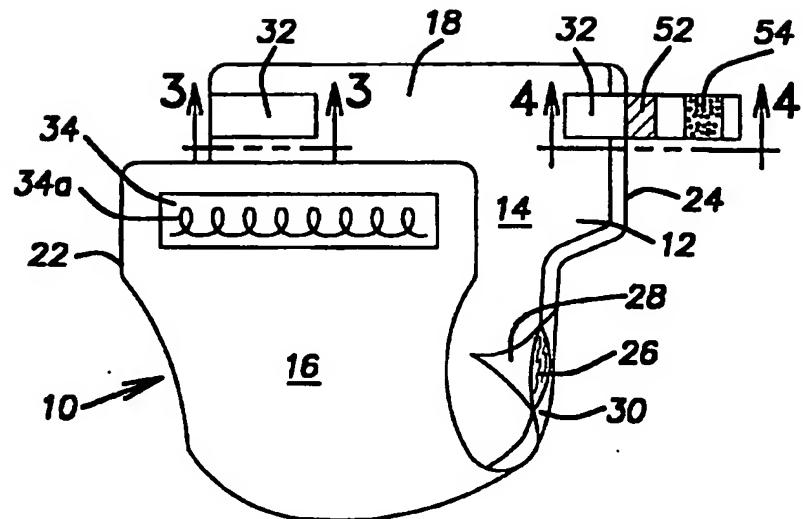


Fig. 1

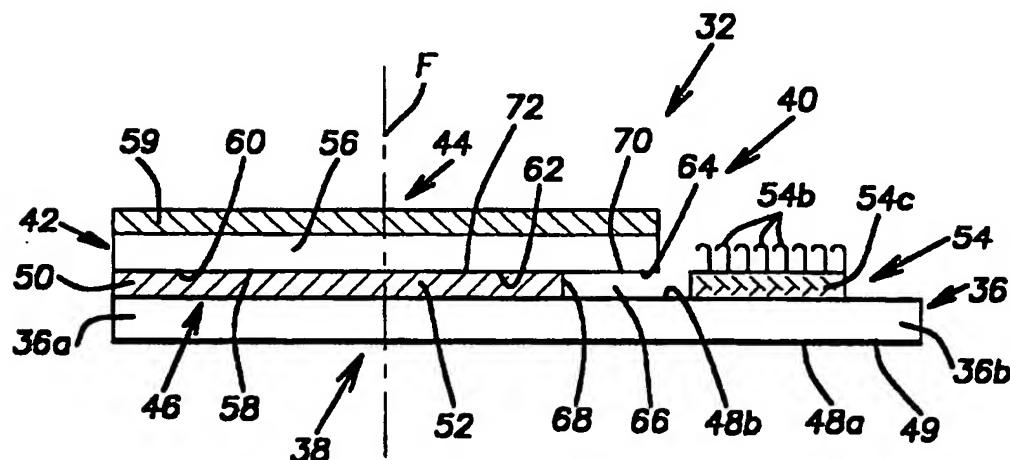


Fig. 2

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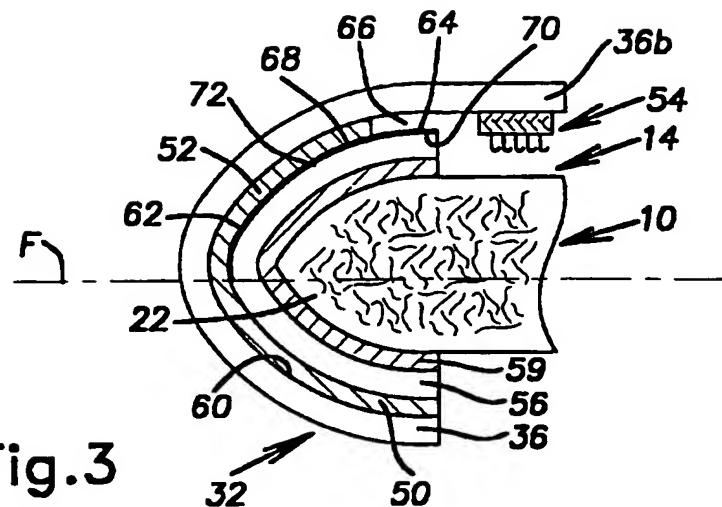


Fig. 3

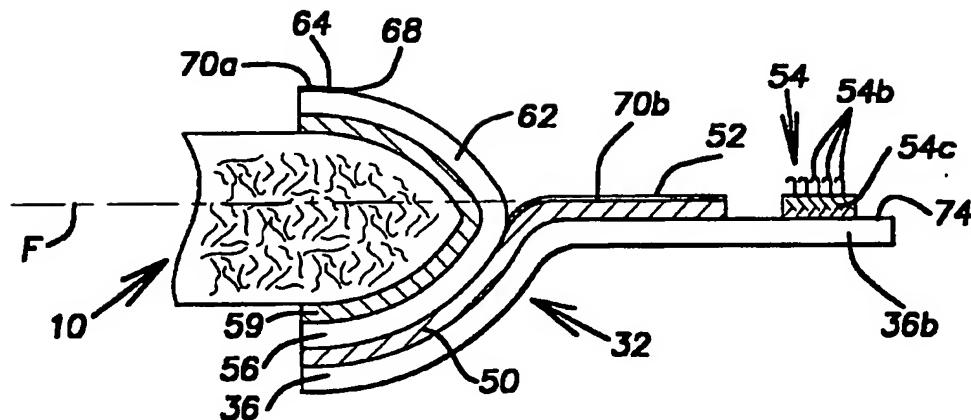


Fig. 4

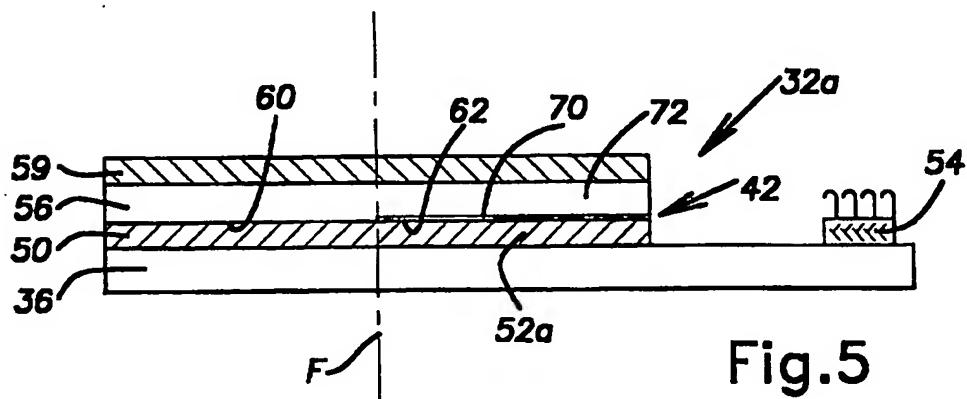


Fig. 5

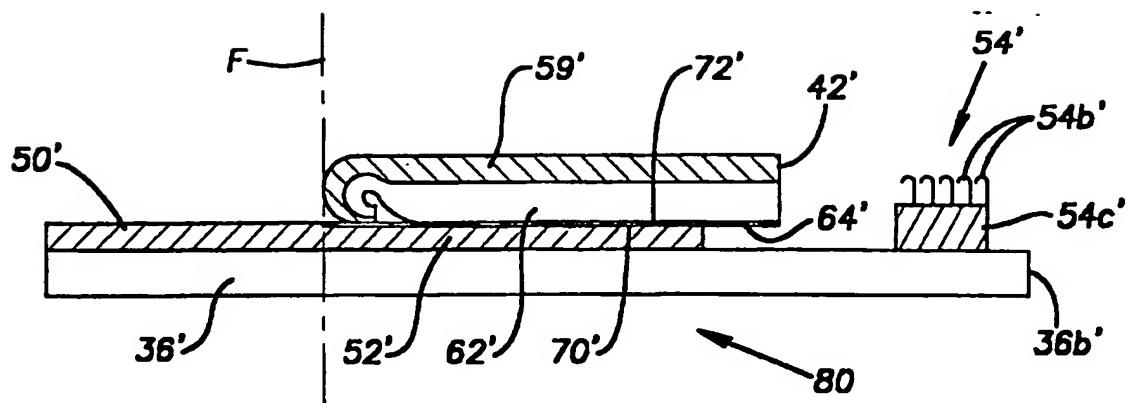


Fig. 6

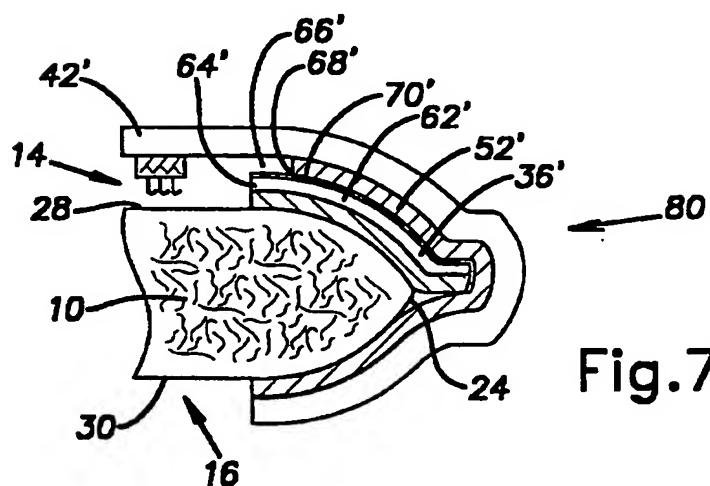


Fig. 7

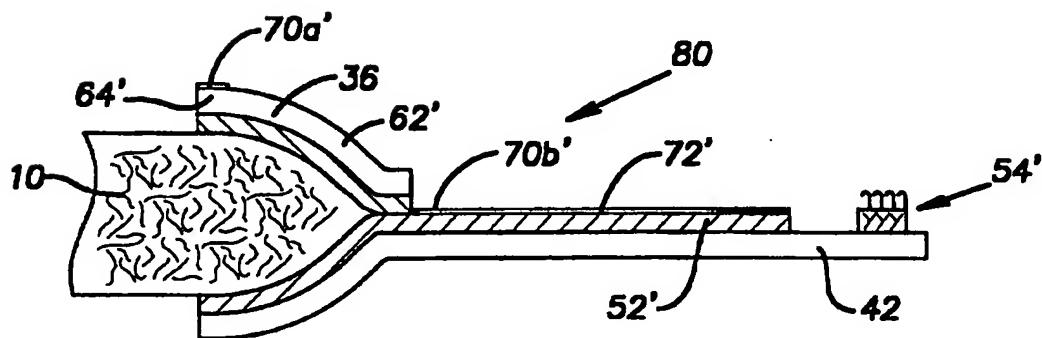
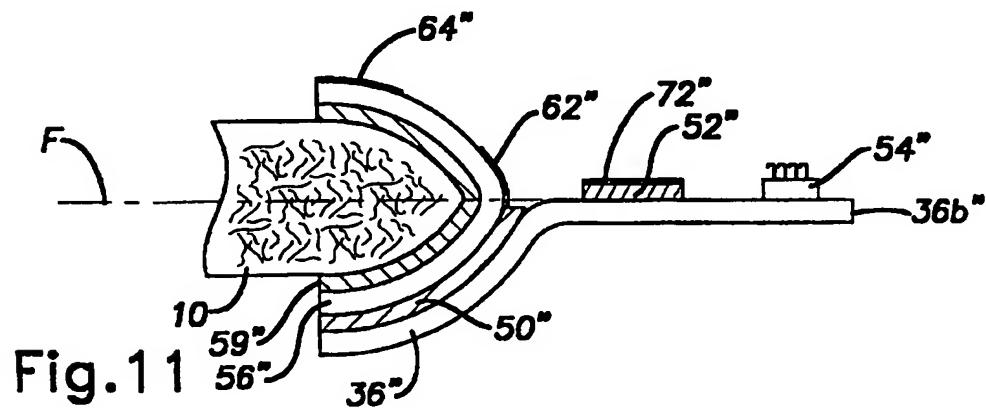
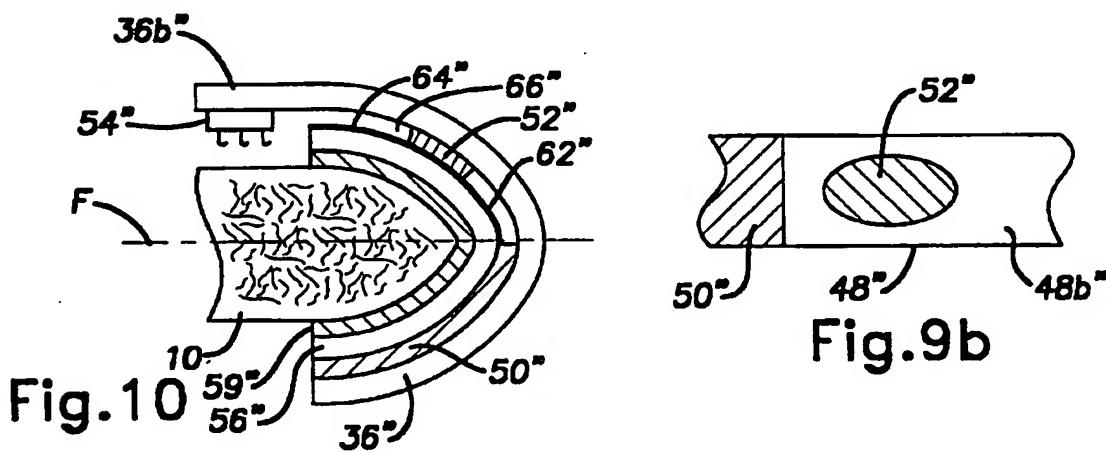
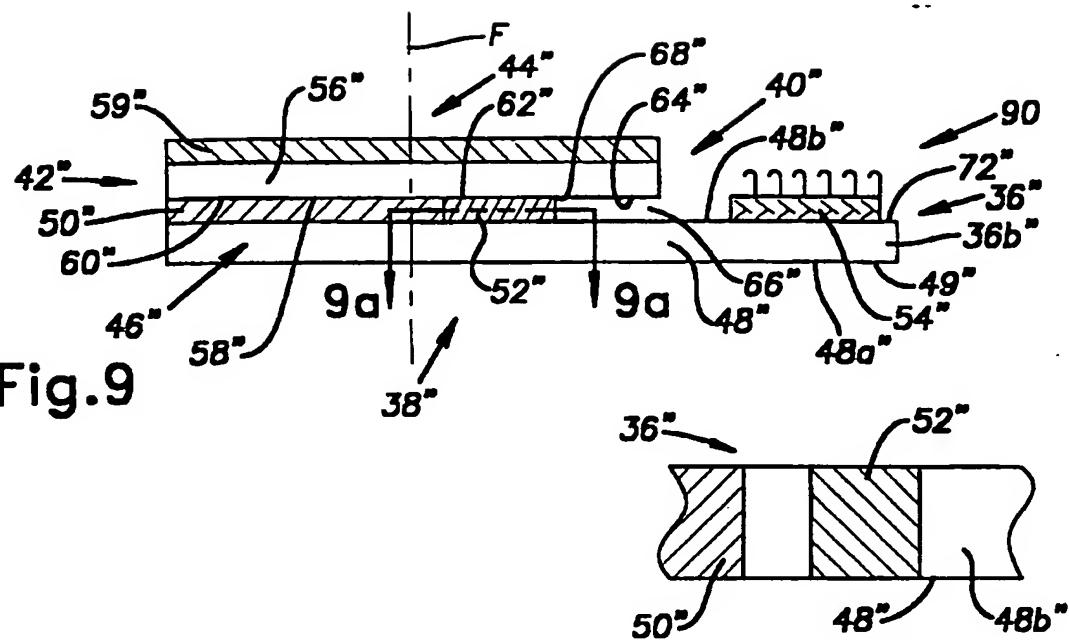


Fig. 8



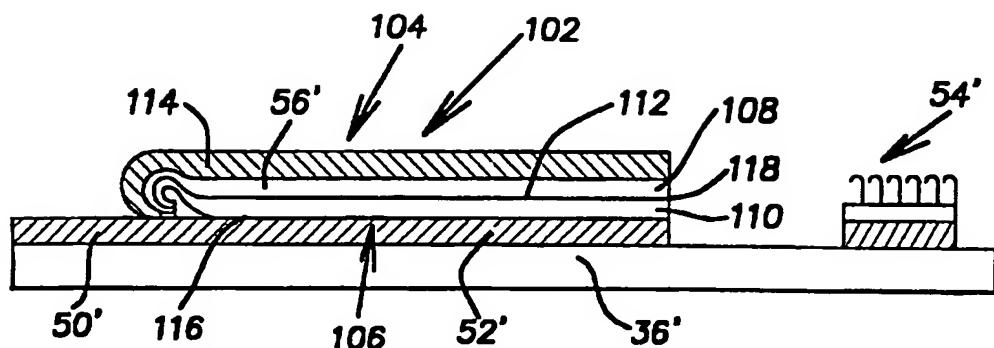


Fig. 12

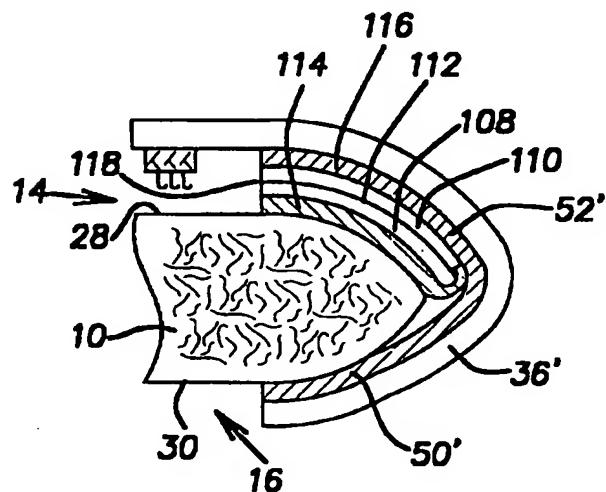


Fig. 13

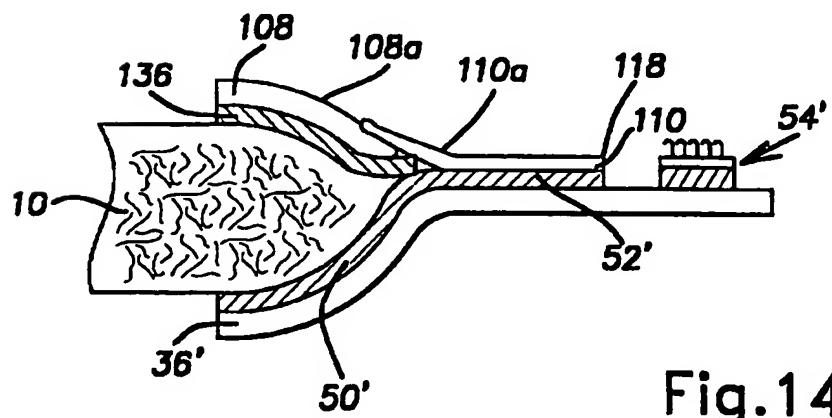


Fig. 14

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US97/01738

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) :A61P 13/15  
US CL :604/391

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 24/306, 402; 428/40.1, 41.8, 42.2; 604/389-391

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 92/21309 A (DHONDT et al.) 10 December 1992, entire document.	1-40

Further documents are listed in the continuation of Box C.  See patent family annex.

Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other relevant events (as specified)	"Z"	document member of the same patent family
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*P* document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search	Date of mailing of the international search report
04 APRIL 1997	01 MAY 1997
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer ROBERT CLARKE <i>Andee Polansky</i>
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